wherein said compressed layer is impregnated with a transparent substance after compression.

* * *

REMARKS

This is in full and timely response to the non-final Office Action mailed April 16, 2002, submitted concurrently with a Petition for Extension of Time to within the first extended month. By this amendment, claim 1 was amended and claim 8 was added, and a substitute Abstract was provided. Claim 1 was amended to recite that said compressed layer of the conductive fine particles contains a resin at the time of compression, said resin being contained at an amount of 9.3 parts by volume or less with respect to 100 parts by volume of said conductive fine particles as represented by volume. Support for this amendment can be found variously throughout the specification, for example, at page 14, lines 22-25 and in Examples 1-6. The present specification recites that the resin is used in an amount of 73 parts by volume or less (page 14, lines 22-25), preferably 55 parts by volume or less, more preferably 37 parts by volume or less, still more preferably less than 18.5 parts by volume (page 16, lines 3-8), with respect to 100 parts by volume of the conductive fine particles as represented by volume before dispersion. Example 1-6 disclose the amounts of resin in 9.3 (Example 5,6), 3.7 (Example 3, 4), 0.037 (Example 1, 2) parts by volume. Support for new claim 8 can be found variously throughout the specification, for example, claim 1. No new matter was added. Accordingly, claims 1-8 are pending in this application, with claims 1-3 and 8 pending for the Examiner's reconsideration, with claims 1 and 8 being independent. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

Objections to the Specification

The Office Action objected to the Abstract of the Specification because it contained 2 paragraphs. By this Amendment, a substitute Abstract is provided. Withdrawal of this objection is respectfully requested.

Rejections under 35 U.S.C. §103

Claims 1-3 are rejected under 35 U.S.C. §103(a) as being obvious over JP 10258486 to Kimura in view U.S. Patent No. 5,662,962 to Kawata et al. Applicant respectfully traverses this rejection.

Claim 1 recites a transparent conductive film comprising a compressed layer of conductive fine particles obtained by compressing a layer containing conductive fine particles that is formed by application onto a support, wherein said compressed layer of the conductive fine particles contains a resin at the time of compression, said resin being contained at an amount of 9.3 parts by volume or less with respect to 100 parts by volume of said conductive fine particles as represented by volume, and said compressed layer of the conductive fine particles is impregnated with a transparent substance after compression.

Accordingly, the present invention discloses a forming process of a compressed layer containing conductive fine particles onto a support, and an impregnating process of the compressed layer with a transparent substance.

Kimura '486 teaches a method for manufacturing a transparent conductive film, in which an ink composition including ITO and binder resin is applied onto a transparent resin film to form a conductive layer and thereafter the layer is calendered. Kawata et al. '962 teaches a transparent electroconductive substrate which is obtained by coating an overcoating liquid over electroconductive film and then dried.

The Office Action alleges that Kimura ''486 overlaps fundamental components (page 3, lines 16-21) and the amount of resin (page 3, line 22 and page 4, lines 1-19) between Kimura's electroconductive film and the claimed compressed layer. Additionally, the Office Action alleges that it would be obvious to combine the ITO porous layer of Kimura '486 with the silica or silica sol material of Kawata et al. '962. Applicant respectfully disagrees.

The Examiner's calculations to justify this rejection are in error. The correct calculated volume of the resin follows:

Kimura '486 discloses in paragraph [0007] that ink composition containing ITO is:

ITO fine powder of 10-30 wt%,

Binder resin of 1-6 wt%, and

Solvent and the like of 64-89 wt%.

Kimura '486 also discloses in Example in paragraph [0010] that ITO ink composition is:

ITO fine powder of 17 wt%,

Binder (polyester resin) of 3 wt%, and

Solvent (cyclohexanone as main component) of 80 wt%.

In Kimura '486, binder resin is used at least 3.3 parts by weight with respect to 100 parts by weight of ITO fine powder according to paragraph [0007]. This corresponds to binder resin at least 16.4 parts by volume with respect to 100 parts by volume of ITO fine powder, as represented by volume. Since specific gravity of ITO is in a range of 6.9-7.1, and specific gravity of binder resin is in a range of 1.2-1.4, using 6.9 as the specific gravity of ITO and 1.4 as the specific gravity of the binder resin results in a possible minimum volume value of binder resin with respect to maximum volume of ITO.

The result is that the amount of Kimura's resin is at least 16.4 parts by volume. The result is that the amount of Kimura's resin is at least 16.4 parts b volume with respect to 100 parts by volume of the conductive fine particles. Therefore, the amount of resin in amended claim 1, 9.3 parts volume or less with respect to 100 parts by volume of the conductive fine particles is not disclosed, taught or suggested by Kimura '486.

Still further, while Kimura '486 teaches a possible minimum amount (16.4 parts by volume) of binder resin, there does not appear to be sufficient foundation or experimental justification of an amount as small as 16.4 parts by volume. Kimura '486 discloses using no less than 87.0 parts by volume, corresponding to 3 weight per cent of resin in the examples at column 4, paragraph [0010].

In contrast, the present specification explains that too large amount, over 73 parts by volume, of resin does not ensure the conductivity among the conductive fine particles "because the contact between the conductive fine particles is inhibited by the insulating resin and, if the amount of resin is too large, the fine particles do not contact with each other, so that the movement of electrons among the fine particles in inhibited." See page 15, lines 3-7. Accordingly, it is doubtful that Kimura '486 can obtain a transparent electroconductive film with excellent conductivity as the present claimed invention.

Kawata et al. '962 teaches "a method for forming a transparent, electroconductive substrate, in which transparent, electroconductive ink ... is coated and dried on a support ... to

thereby form thereon a transparent, electroconductive film ..., and thereafter an overcoating sol solution ... is coated on said transparent electroconductive film and then dried or dried and baked." See column 15. Lines 29-39. Still further, "a method for forming a transparent, electroconductive substrate, in which a transparent, electroconductive ink ... is coated ... and then dried and baked to thereby form a transparent, electroconductive film on the support, and thereafter an overcoating sol solution ... is coated on said transparent electroconductive film and then dried or dried and baked." See column 16, lines 30-40. Thus, the method of Kawata et al. '962 comprises a baking process. This baking process promotes "the sintering of the contact area between the electroconductive, ultra-fine particles" (column 5, lines 29-30) in order to "lower the resistance of the electroconductive film", see column 5, lines 33-34. This baking process is operated at about 400°C or higher (column 5, lines 28-29) in air and then 400°C to 600°C in an inert gas atmosphere. See column 5, lines 31-32.

In contrast, the present invention comprises a compressing process for obtaining conductive property. In the compressing process, the compression increases the number of contact points among the conductive fine particles to increase the contact area and the electric resistance is reduced. See page 22, line 25 to page 23, line 3. Accordingly, the electric resistance is reduced without calcining at a high temperature. See page 9, lines 7-8. The present specification clearly recites the unfavorable influence of the calcining process at page 4, lines 17-21, whereby "since a calcining step at a temperature higher than 300°C must be carried out, it is difficult to form a conductive film on a support such as a resin film. In other words, the resin filmwill be melted, carbonized, or burnt by the high temperature."

Not calcining at a high temperature permits the support to be "various ones such as resin film, glass, ceramics and others." See page 19, lines 7-8. Furthermore, the use of resin film results in weight reduction (page 19, line 17) and good close adhesion of the conductive fine particle layer to the film. See page 19, lines 15-16. The peel test result in the Example to evaluate the close adhesion of the conductive layer to the support film and the strength of the conductive layer reflects this remarkable effect. Additionally, the use of the resin film brings excellent flexibility of the transparent conductive film.

Accordingly, for all the reasons discussed above, it would not be obvious to make the transparent conductive film of claim 1 by coating the porous ITO layer of Kimura "'6 with the silica or silica sol material of Kawata et al. '962.

Dependent claims 2-3 depend from claim 1, are also allowable for the reasons above. Moreover, these claims are further distinguished by the materials recited therein, particularly within the claimed combination. Withdrawal of the §103(a) rejection is therefore respectfully solicited.

* * *

Conclusion

For the foregoing reasons, claims 1-3 and 8 are allowable, and the present application is in condition for allowance. Accordingly, favorable reexamination and reconsideration of the application in light of these amendments and remarks is courteously solicited. If the examiner has any comments or suggestions that would place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the number below.

Respectfully submitted,

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Should additional fees be necessary in connection with the filing of this paper, or if a petition for extension of time is required for timely acceptance of same, the Commissioner is hereby authorized to charge Deposit Account No. 180013 for any such fees; and applicant(s) hereby petition for any needed extension of time.

Appendix I

In accordance with 37 CFR 1.121(c)(1)(ii), amended claim 1 is set forth in a marked-up version below:

1. (Amended) A transparent conductive film comprising a compressed layer of conductive fine particles obtained by compressing a layer containing conductive fine particles that is formed by application onto a support,

wherein said compressed layer of the conductive fine particles contains a resin at the time of compression, said resin being contained at an amount of [73]9.3 parts by volume or less with respect to 100 parts by volume of said conductive fine particles as represented by volume, and

said compressed layer of the conductive fine particles is impregnated with a transparent substance after compression.

Appendix II

In accordance with 37 CFR 1.121(b)(1)(iii), the amended Abstract is set forth in a marked-up version below:

ABSTRACT OF THE DISCLOSURE

[A transparent conductive film with a low electric resistance value and little scattering obtained by an application method, and method for producing the transparent conductive film are provided.]

A transparent conductive film with a low electric resistance value and little scattering obtained by an application method, and method for producing the transparent conductive film are provided. A transparent conductive film comprising a compressed layer (12) of conductive fine particles obtained by compressing a layer containing conductive fine particles that is formed by application onto a support (14), wherein the compressed layer of the conductive fine particles contains a resin at the time of compression, the resin being contained at an amount of 73 parts by volume or less with respect to 100 parts by volume of the conductive fine particles as represented by volume, and the compressed layer of the conductive fine particles is impregnated with a transparent substance after compression. The layer containing the conductive fine particles is formed by applying a dispersion liquid, which contains the conductive fine particles and the resin, onto the support and drying the liquid, the resin being contained at an amount of 73 parts by volume or less with respect to 100 parts by volume of the conductive fine particles in the dispersion liquid as represented by volume before dispersion.